DETERMINATION OF THE IMPROVEMENTS REQUIRED FOR THE PRODUCTION AND EXPORT OF QUALITY HONEY FROM RWANDA

September 2004

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ABREVIATIONS AND ACRONYMS

ADAR	Assistance à la Dynamisation de l'Agribusiness au Rwanda
ARDI	Association Rwandaise pour la promotion du Développement Integré
FAV	Forum Apiculteurs Volcano
IGCP	International Gorilla Conservation Programme
FRW	Rwanda Franc

EXECUTIVE SUMMARY

This report summarizes a rapid assessment of the current situation of the apiculture sector in Rwanda, and in particular with respect to the potential for honey export. The natural, human, social, physical and financial resources available for apiculture are described.

While there are sufficient natural resources, beekeeping has not taken off as a significant source of income for rural people because there is no well established market for their products. Neither NGO's nor Government is providing significant support to develop and protect the sector.

Honey is not available in the quantity and quality needed for export. To develop a market for honey two things are needed simultaneously: beekeepers harvesting significant quantity and quality of honey and beeswax, and a system in place to give a fair, immediate cash payment for products that are of sufficient quality. ***On the international market, Rwanda will only have comparative advantage for specialized, niche market honeys.***

To alleviate the constraints facing the sector, this report makes recommendations to address four key issues: training of trainers and training of farmers; the establishment of honey and beeswax collection centres; market development and training of honey traders; and the development of Government policy to protect the apiculture sector.

1. INTRODUCTION

1.1. Activities undertaken

The assignment reported here took place during one week, 13 – 20 July 2004. To gain widest understanding of the situation within the days available, meetings were organized with groups and individual beekeepers. A field visit was made to the western side of the country, meeting with individual beekeepers, their groups and supporting NGO's. I was accompanied in these field visits by Mr. Donatien Murenzi, a potential honey exporter, and Mr. Jean Bosco Seminega of ADAR. The Task Order Scope of Work is shown in Annex A.

1.2. Acknowledgements

I would like to thank staff of the ADAR Office in Kigali for their assistance, especially Dr Anne Turner, in enabling the best use of a short time with smooth arrangements throughout. Mr. Donatien Murenzi and Mr. Jean Bosco Seminega ensured that the fieldwork was informative and worthwhile, and with the cautious driving of Mr. Martin Kanyarwunga. I thank the many beekeepers and farmers that we met, who shared their time, experience and delicious honey with us.

2. FINDINGS

2.1. In Summary: A Strength, Weaknesses, Opportunities and Threats analysis of apiculture in Rwanda

Strengths

- Natural resources for apiculture are good: adequate populations of healthy, disease and (parasitic) mite-free honeybees. Good crop and wild plant resources of forage for bees, water and natural materials for beekeeping.
- Human resources: many people have traditional beekeeping skills; there are some training and extension skills.
- Social resources: there is some sectoral support from national and local NGO's.
- The industry generates valuable outputs for Rwanda; the most economically important (but difficult to quantify) of these is the pollination of crops. The products of beekeeping, honey and beeswax can have value at village level as well as on the national and international markets.
- The industry is a viable source of income for rural people with few financial resources.

Weaknesses

- There is no national beekeepers' NGO working only for the good of its members. Organizations supporting beekeepers are also involved in buying and selling of honey and this creates conflicts of interest.
- Lack of appropriately trained training and extension personnel.
- Lack of appropriate training and extension materials.
- Lack of physical resources: access to containers, roads, transport and communication.
- Poor market access for producers.
- Low product prices for producers.
- Lack of access for traders to products of sufficient quality and quantity.
- Lack of access to or non-availability of credit.
- Poor diversity of retail packaging materials.
- No linkages between producers and traders.
- No product promotion.
- No coordination between beekeeping and other sectors: horticulture, forestry, environment sectors.

- Beekeeping skills, training and extension resources provided by NGOs may be inappropriate (based on technology used in industrialized countries utilising European races of honeybees).
- The Government of Rwanda offers little or no support to beekeepers.
- No beekeeping policy for protection of the industry.

Opportunities

- Poverty alleviation: with appropriate training, people can create livelihoods from beekeeping towards helping themselves out of poverty.
- Even the poorest people, living in remote places, could achieve significant individual production levels, if a market existed
- Honey and beeswax could create livelihoods for several other sectors within Rwanda, including traders working in informal and formal markets, and artisans manufacturing equipment.
- Honey market development: there is scope for increasing product volume and quality and establishing the unique identities of different Rwandan honeys.
- Establishment of a market for beeswax.

Threats

- Loss of habitat for bees.
- Loss of bees from pesticide use.
- Loss of potential international markets for honey and beeswax due to residues of pesticides or antibiotics detected in bee products.
- Disillusionment among donors concerning the effectiveness of beekeeping interventions.

2.2. Concerning the resources available for apiculture in Rwanda

2.2.1. Natural resources

2.2.1.1 Bee resources

The honeybees used by beekeepers are indigenous 'wild' bees and are in no sense 'domesticated'. These honeybees have evolved according to the prevailing climate, seasons, flora and predators, and are better suited to local conditions than bees introduced from elsewhere could be. The species of honeybee in Rwanda is *Apis mellifera*, the same species that occurs throughout Africa, Europe and the Middle East, and that has been introduced widely throughout the rest of the world. The races present in Rwanda are *Apis mellifera scutellata*, and perhaps *Apis mellifera adansonii* and *Apis mellifera monticola*, a montane race likely to occur in high altitude areas like Volcanoes National Park.

Races of African honeybees have behaviour and biology different from European honeybees that have evolved in temperate climates. Tropical bees have evolved a specific survival strategy: when conditions become adverse, they move to a new area, and show more 'nomadic' behaviour than do honeybees in temperate zones. Tropical bees can afford the risk of moving their nest sites because a long winter period does not lie ahead. Because tropical bees readily abscond when the colony is disturbed, European methods of honeybee management are not appropriate for tropical bees. This important yet poorly appreciated fact explains one reason why European methods do not work well with tropical bees.

Beekeepers using local methods in the tropics understand that honeybee colonies are mobile and accept that sometimes their hives will be unoccupied. For example, a beekeeper may own 100 hives but at any time, perhaps only 25% will be occupied by honeybees. This mobility of bee colonies must be appreciated when interviewing farmers or reviewing statistics: number of hives, and number of honeybee colonies, may seem like similar questions but will have different answers.

2.2.1.2. Health of honeybee populations

Few countries worldwide enjoy Rwanda's current situation of indigenous stocks of honeybees, free of major bee diseases and parasites. It is essential that efforts be made to maintain this good situation. Asian honeybees have already been introduced to Sudan, and Asian parasitic honeybee mites have been introduced to Southern and Northern Africa.

2.2.1.3. Plant resources for bees

Indigenous forest resources provide excellent forage and nesting habitat for honeybees, as well as the materials to make hives, and remaining areas will provide the best resources for beekeeping. The Eucalyptus trees that have been widely planted provide abundant nectar and pollen for bees, and represent a greatly under-utilized resource. Crops grown in Rwanda: coffee, pulses, oil seeds, fruits, vegetables and spices, all provide useful forage sources for bees. Many of these crops benefit from insect pollination, producing higher quality and quantity of fruits and seeds (see Table 1).

2.2.1.4. Materials for beekeeping

Local beekeeping practices use whatever materials are available. Hive designs in Rwanda vary according to the local habitat type, and include banana leaves, palm, logs, grasses, sticks, woven bamboo, and lantana.

2.2.1.5. Pesticide use

Spraying of pesticides may be a major problem for beekeepers in coffee and (to some extent) tea growing areas. Pesticide use will not only reduce apiculture by killing bee populations, but will also reduce the coffee crop by lack of pollination. There may be great benefit to be obtained from ceasing spraying and thus allowing flowers to be adequately pollinated and ultimately enabling the coffee crop to be certified organic.

2.2.2. Human resources

2.2.2.1. Local beekeeping skills

This is the way of harvesting from bees using traditional skills and local equipment. It has been a sustainable activity using technology that has withstood the test of time (2,000+ years - some believe that beekeeping first developed in this region 5,000 years ago).

Traditional beekeeping in Rwanda is practiced with varying degrees of skill. Some beekeepers harvest their hives by climbing the tree and removing only honeycombs, thus leaving the colony relatively unharmed. As the bees are not continually disturbed, the bees are not highly defensive and may be kept conveniently near to home. At the other end of the skill range, some simply lower the hive to the ground, use fire to attack the bees, remove the whole contents and thus destroy the bees and the hive.

Honey is regarded as ripe when the bees have reduced the water content to around 20%, at which point they place a white capping of beeswax over the cell. Honey at this stage inside the bees' nest (whatever type of hive is used) is of 100% perfect quality, and will not ferment. The beekeeper's aim must be to retain this quality during harvesting and handling, by not allowing any contamination of the honey to occur, and by ensuring that the honey is not overheated at any stage between harvest and point of sale.

For Rwandan beekeepers to harvest honey of the best possible quality, they must proceed as is described below:

1. If harvesting from local style hives (see section 2.2.3.2. below), they must harvest only fully 'ripe' (i.e. sealed) honeycombs. Separate harvested honey into first and second quality, where first quality is with combs that are 90-100% sealed, and second quality is where a larger proportion of cells are unsealed.

Figure 1

Rwandan beekeepers with frames containing honey - the white regions are areas of capped, ripe, perfect honey.

2. If harvesting from frame hives beekeepers must harvest only fully 'ripe' (i.e. sealed) honeycombs. Put unripe combs back into the hive until they are ready for harvest.

Otherwise, the rules are the same, whatever type of hive has been used:

- Use as little smoke as possible during harvest
- Harvest honey into clean, dry, odour-free containers
- Plastic or tin sieves or cotton or nylon cloth can be used to filter honey, to remove any dead bees, scraps of wax, etc. Finely woven baskets can also be used for the first filtration of honey from wax.
- Every tool and container used must be clean, dry and odour- free.
- Use only clean, odour-free containers for honey storage, keep them well sealed, and store in a safe, cool, dry place.
- Practice standards of hygiene as for any other food preparation.

2.2.2.2. Positive aspects

- Local beekeeping methods provide a source of financial income with no financial input.
- It is possible to harvest top quality honey and beeswax from local hives.
- This activity can be entirely sustainable and need not harm bees. Beekeeping does not compete for resources used by any other form of agriculture: unless harvested by bees, the nectar and pollen inside flowers plants will not be utilised.
- Only a little training, and a few inputs are needed to upgrade farmers' skills.

2.2.2.3. Negative aspects

- Beekeepers are often blamed for starting forest fires.
- Less-skilled beekeepers kill the honeybee colony when they harvest from it, making this non-sustainable when combined with habitat loss, and loss of bees by pesticides.

Training and extension resources

Most farmers have had no training in beekeeping and have no written information. Where training has taken place, there seems to have been too much emphasis on telling farmers about more expensive hive technology and techniques that are not feasible. I do not know how many technical staff working with farmers have practical experience of beekeeping. Very little or no extension literature is available.

NGO's providing beekeeping training seems to be also involved in buying honey. The issue of conflict of interest arises: it is in the interest of beekeepers to learn how to harvest and filter perfect honey and beeswax, and to add value to their products, while it is in the interest of buyers for products to remain in crude form.

2.2.3. Physical resources

2.2.3.1. Containers and packaging

Beekeepers sell their honey in villages and town markets in whatever containers are available. Honey in larger volumes is carried in the ubiquitous yellow plastic jerry cans. These are not suitable for honey as they have a narrow neck. A better option for processing and transporting honey is stackable, plastic buckets with tight fitting lids. Using these buckets, beekeepers can sort honey into first and second quality at time of harvest, and they can be used for filtration of honey. Plastic jars, lids and labels of poor quality are available: there is little diversity. Woven polypropylene bags are adequate for transporting blocks of beeswax.

2.2.3.2. Hive technology choice

Choice of technology for beekeeping depends upon the resources available to the beekeepers. Hives must be easy to make and mend locally.

Traditional local style hives

Local style hives can be made from any available materials, and can be hollowed-out logs, bark formed into a cylinder, clay pots, woven grass, cane: whatever is suitable and available. The sole purpose of the hive is to encourage bees to nest in a place accessible to the beekeeper. The bees build their nest inside the hive, just as they would build it in a naturally occurring cavity. Eventually the beekeeper plunders the nest to obtain crops of honey and beeswax. Bees may or may not be killed during this process, depending on the skill of the beekeeper. If the colony is destroyed, the hive will remain empty for a while. If there are plenty of honeybee colonies in the area, eventually a swarm may settle in the empty hive and start building a new nest. Traditional beekeepers often own many hives and expect only a portion to be occupied by bees at any one time. All required materials should be locally available, but traditional beekeepers can benefit from assistance with access to protective clothing, smokers and containers for the honey, and with help in locating markets for the products.

Figures 2 and 3 : Local style hives in Rwanda.

The hives shown here are hollowed out logs, protected from rain and sun by an outer coat of banana leaves and secured with stems.

Figure 4 - ***This picture shows a number of local style hives in south west Rwanda – some are hidden on the ground, protected from rain and sun by eucalyptus branches, and some in trees, and on the right one blue frame hive.***

2.2.3.3. Modern low-technology hives: top-bar hives,

Top-bar hives are an attempt to use equipment that is appropriate to the resources of rural people, and allow beekeeping to be practised in an environmentally acceptable way; however, these do not seem to be known in Rwanda, despite their widespread use in neighbouring countries.

2.2.3.4. Frame hive beekeeping

This style of hive was developed 150 years ago, and is used in industrialized countries world-wide, beekeeping with European (temperate zone) honeybees. The bees are housed in rectangular boxes, and encouraged to build their combs inside rectangular frames. These frames can be removed from the hive. Honey is extracted from the combs and the empty wax combs are returned to the hive. In this way, the bees put their effort into producing honey rather than beeswax, as the wax combs are continuously re-used. In a frame hive, rectangular wood frames are used to support the bees' combs. These frames have two major advantages:

- They allow inspection and manipulation of colonies, such as moving frames of bees or stores from a strong colony to strengthen a weaker one.
- They allow efficient harvesting of honey because the honeycombs within their frames can be emptied of honey and then returned to the hive. This allows increased honey production, as the bees do not have to build fresh comb.

Frame hives consist of a series of wooden boxes stacked on top of one another. Frames are contained within the boxes, arranged like suspension files in a filing cabinet. Usually the bottom box is used for the brood nest, which is where the queen lays her eggs, and young bees develop.

A queen excluder is placed between the box with brood and the box above it. The queen excluder is a metal grid with holes that allow worker bees to pass through, but not the queen, because of her larger size. This ensures that only honey is stored in boxes above the queen excluder. In addition to the boxes and frames, a hive stand, floor and roof are required, along with various other specialized items of equipment.

Figure 5 - ***Frame hives (in Europe). In this (unusual) case, each box has been painted a different colour. The bottom box contains the queen and developing bees. The queen is prevented from entering the upper boxes by a queen excluder (see below), a metal grid that allows worker bees to pass but not the larger size queen or male drones***

Figure 6 - ***Bottom box of a frame hive with a queen excluder on the top***

Frame hives must be constructed with precision. Boxes need to fit together precisely, and the spacing between frames must be the same as spacing in a natural nest. Frame hives require well-seasoned timber, planed and accurately cut, as well as other materials such as wire, nails and foundation. They are therefore relatively labour intensive to make and maintain. There must be access to replacement parts, particularly foundation and frames.

Over the last hundred years, various attempts have been made to introduce frame hive beekeeping to Rwanda. Beekeeping trainers refer to this style of beekeeping as 'modern' beekeeping. Beekeepers only harvest more honey from frame hives than from traditional hives as long as the bees remain in the hive, and all the ancillary equipment is available. During the brief field visit reported here, I saw a few frame hives in use, with no examples of significant, successful use. Given here are some reasons why frame hive beekeeping may be inappropriate for promotion within Rwanda:

- Beekeepers can easily own up to 100 local style hives and accept that at any time only a portion will be occupied by honeybee colonies. The more hives they have, the greater their chance of having bees. The financial investment required for frame hives makes it impossible for subsistence farmers to own similar numbers of these hives.
- Simple economic analysis of frame hive versus local hive technology reveals that the costs far out weigh possible benefits. Currently one frame hive costs around 30 $US. One traditional hive sells for 1,000 FRW, (although beekeepers would usually make their own hives). Frame hive beekeeping also requires other equipment to be bought. An economic study of the different technologies has been done in Zambia: at subsistence level, traditional beekeeping is more economical.
- Frame hives depend upon precision manufacture such that the various wooden parts fit well together. Under tropical conditions hives warp, and cracks and gaps appear which make the bees susceptible to predators, and makes the work of the beekeeper yet more difficult. Even if they do not abscond, the stress makes honeybee colonies more defensive, and beekeepers will perceive them to be more aggressive.
- Not only is the equipment needed for frame hive beekeeping expensive, it may be difficult to obtain in rural areas of Rwanda. In addition to the hive boxes, frame hive beekeeping needs nails, wire, beeswax foundation sheets, a honey extractor as well as other items.
- Tropical African bees are difficult to manage in frame hives (especially *Apis mellifera adansonii*). This negates the point of the increased manageability conferred by frame hives.
- Beeswax (rather than just honey) should be an important product and indeed export crop for Rwanda. However, the honey efficiency of frame hives is derived at the expense of wax production – the frames containing honeycombs are emptied of their honey in a centrifugal extractor and returned to the hive.

2.2.3.5. Processing equipment

At village level, simple equipment (buckets, straining cloths) is adequate for processing honey and beeswax harvested from local hives.

Figure 7 - ***Honey straining through cloth into a bucket: FAV beekeepers, Rwanda***

For the volumes of honey available in Rwanda, the main equipment required are plastic buckets with tight fitting lids, straining cloths etc. as described above. The only item of equipment that would need to be imported is a honey refractometer to measure water content (described below in Section 4.2. (Cost US$100-200).

Once harvested, honey need not necessarily require further processing. On a small scale, simple equipment as used in other forms of food preparation is adequate: plastic buckets, bowls, sieves, straining cloths and containers. Honey is a stable commodity with a long shelf life: if harvested carefully and stored in containers with tight-fitting lids, it will remain wholesome for several years.

Honey is a food and it must therefore be handled hygienically, and all equipment must be perfectly clean and without any odour of cleaning materials. Honey processing is inevitably a sticky operation and the honey processor will continuously be cleaning equipment. However, because honey is hygroscopic and will absorb moisture, all honey processing equipment and containers must be completely dry. Any water being added to honey increases the chances of fermentation.

Processing honeycombs from local style (fixed comb) hives

Cut-comb honey

Because the whole comb is harvested from these hives, it is possible to harvest pieces of cut-comb honey for sale this way, although I did not see any honey on sale in Rwanda in this form. Select pieces of comb consisting only of sealed and undamaged honeycomb, cut them into neat portions and package them carefully for sale. Since the honey in the comb is untouched and is readily seen to be pure, honey presented in this way always fetches a good price, and honey that has not been open to the air has a finer flavour than honey that has been subjected to processing in any way. Beekeeping equipment suppliers sell cutters to cut uniform sizes of comb, and plastic boxes with transparent lids for selling cut comb honey. To obtain sections of comb of uniform size, the sharp edge of a tin can makes a useful comb cutter.

Strained honey

The simplest way to prepare strained honey is to remove the wax cappings of the honeycomb with a knife, break the combs into pieces, and strain the honey from the wax. As described above, be sure not to use unsealed combs containing unripe honey or pollen. Strained honey must not contain any trace of beeswax or other debris. It is best to first use a coarse strainer to remove large particles, and then to use successively finer strainers. Use a cotton cloth, basket, or sieve to strain the honey from the pieces of honeycomb. Collect the honey that strains through in a clean and dry container. Finally squeeze the combs inside a bag made from the cloth to remove as much honey as possible. Do not discard the empty wax comb - it is valuable! Form the wax into a block by melting it gently in a water bath or solar wax extractor.

With larger volumes of comb, it may be worthwhile to make or buy a press. This has a container for the pieces of comb and a mechanical device to squeeze them.

Processing honeycombs from frame hives

Cut-comb honey

To produce cut-comb honey from frame hives it is necessary to use beeswax foundation that does not contain strengthening wires. The wax foundation should also be thinner than that normally used in wired frames. Portions of cut-comb can then be prepared for sale as described above. After the combs are cut, the frames must be refilled with fresh foundation sheets before returning to the hive.

Strained honey

Figure 8 - *'Uncapping', i.e. using a fork to remove the wax capping from honey so that the honey can leave the cells when spun in the extractor (Rwanda July 2004)*

Remove the wax capping from the frames of honeycombs with a long, sharp knife. If the room is cold, then the knife may be one that is heated electrically (obtainable from equipment suppliers), or which has been standing in warm water. In the latter case, it is important to dry the knife before use. Hold one end of the top-bar of the frame and rest the other end of the top-bar on a piece of wood placed across a collecting tray - the frame is therefore held at right angles to the tray. Start cutting downwards across the frame, and with a zigzag movement of the knife, cut off the thin layer of wax capping and allow it to fall into the dish below the frame. Turn the frame around and cut off the capping from the other side, and then place the frame in the extractor. Practice makes perfect with this task – the trick is to cut all the wax cappings, but with as little of the honey as possible. Some honey will stick to the wax cappings; do not waste this, but strain it out of the collecting tray. Honey drains slowly from cappings and this process may take over 24 hours.

Honey extracting

Figure 9

Figure 9 - ***Using a tangential extractor to spin honey out of frames. (Rwanda July 2004)***

Figure 10

Figure 10 - ***Placing the frames in the vertical baskets inside the extractor. (Rwanda July 2004)***

A honey extractor is a machine to remove honey from combs in frames by rotating them at high speed so that honey is thrown out of the comb on to the wall of the extractor, and then runs down to the bottom of the drum. Honeycomb built inside a wooden frame is not damaged by this process and when empty, can be returned to the hive. The extractor consists of a metal drum containing holders in which the frames are placed. There is a tap at the base of the container so that the honey can be run out. There are two types of extractor: tangential and radial. The tangential extractor is the most common type, being relatively easily available and appropriate for small-scale beekeeping. The tangential extractor holds two, three or four combs in cages, held at right angles to the radius of the container, and is usually hand operated. Although it sounds complicated, a village blacksmith can make a radial extractor. Plastic bins can be modified to serve as the drum, and parts from bicycles can be used to provide the means for spinning. Radial extractors are larger than tangential ones and often hold up to 20 frames arranged radially inside the cylinder. Radial extractors are usually operated with electric motors.

Honey should always be strained as it runs out of the extractor so that any pieces of wax capping, dead bees or splinters of wood (from frames) are removed.

Storage

Honey must be stored in clean, dry buckets with tight fitting lids. As long as it is kept away from heat, it can be stored this way until it is packaged for consumption or sale.

2.2.3.6. Roads, transport and communication

Lack of these resources has consequences for beekeeping. Little or no access to transport is the reason why producers often have no market or obtain the lowest prices for their honey. However the development of the good telecommunication infrastructure in Rwanda gives much better opportunity for contact between traders and collection centres.

2.2.4. Financial resources

Lack of credit may be a constraint for selling and buying honey. Farmers expect honey collection centres or private sector traders to pay cash when they bring honey, otherwise farmers prefer to sell their honey "by the spoonful in the market" for an instant, although lower cash return. Those buying honey may have problems in accessing the credit they need. A viable and sustainable financial system for buying honey and beeswax will be a key element towards increased apicultural development.

2.2.5. Social resources: sector support

The Government of Rwanda has no personnel with responsibility for beekeeping. In 1992, responsibility for apicultural extension was contracted to the NGO ARDI. However, it is not clear if a contract still exists. ARDI and other NGO's are involved with promoting beekeeping and with buying honey and beeswax from beekeepers and therefore there are conflicts of interest. In the time available it was not possible to understand fully the activities that are underway, however there seems to be considerable focus on the free distribution of frame hives (funded by donors), and little assistance with technical help or assisting with issues that beekeepers face.

There is no Government policy concerning apiculture, its development or protection of indigenous honeybee populations, nor systems in place for the certification of honey for export.

2.3. Concerning the potential benefits of apiculture in Rwanda

Honeybees in Rwanda give three nutritionally and/or financially important outputs:

- Pollination of crops
- Honey
- Beeswax and (potentially) propolis

Other outputs, which are impossible to quantify, include:

- Pollination of indigenous and introduced plants
- Financial incentive for people to retain vegetation
- Trade for different sectors: manufacturers of equipment and secondary products, traders and retailers.

2.3.1. Pollination of crops

Adequate insect pollination contributes towards optimal quality and quantity of crop yields. Farmers have little awareness of the importance of ensuring adequate pollination.

Table 1. The pollination requirements of crops grown in Rwanda

Crop	Resources for bees	Crop improved by bee pollination?
Coffee	Nectar	Yes: more and larger berries with higher oil content
Tea	Nectar, if allowed to flower	No
Oil seeds	Nectar and pollen	Yes
Eucalyptus	Nectar and pollen	No
Fruits	Nectar and pollen	Most require pollination for optimal fruit quality and quantity
Vegetables	Nectar and pollen	Most require pollination for optimal production. Root crops depend on pollination for seed production
Spices	Nectar and pollen	Most require pollination for optimal production

2.3.2. Products of beekeeping: honey and beeswax

Local beekeeping methods generate a product that is a mixture of broken wax honeycomb, honey and, depending on the technique used, bee larvae and pupae, and pollen. This product is either consumed by the beekeeper's family or put in jerry cans and sold on to dealers. Beekeepers are not aware of the potential value of their beeswax as they sell it along with their honey, and indeed may see it as a contaminant, unaware that this product has higher value than honey.

2.3.2.1 Individual production levels

The main constraint on production is the amount that can be sold. Resources of bees and forage for bees are not likely to be limiting factors. Farmers can readily double production, if there is a market for the honey. There are two main seasons for honey production, with a local hive yielding around 5-10 kg per season.

2.3.2.2. National production levels

Around 50 tones of honey are being handled by organizations encountered during this mission. Is honey production this low, or is more honey flowing through invisible, informal channels? My expectation is that more is being produced and flowing out of Rwanda to traders from Uganda and beyond.

3. CONCLUSIONS

3.1. Constraints for farmers

- Lack of training and technical advice, or poor quality training.
- Lack of appropriately-skilled trainers.
- Lack of training materials.
- No access to suitable containers.
- No access to protective clothing and smokers.
- Poor market access.
- Low product prices.
- Lack of an organization representing the interests of beekeepers.

3.2. Constraints for traders

- Lack of products of sufficient quality and quantity.
- Lack of access to and/or information about products.
- Non-availability of credit.
- Poor diversity of retail packaging materials.

3.3. Constraints for the industry as a whole

- Weak linkages between producers and traders.
- No coordination between beekeeping and other sectors: horticulture, forestry, health, environment sectors.
- No product promotion.
- No beekeeping policy for protection of the industry.

4. RECOMMENDATIONS TO ADDRESS KEY ISSUES

Considering the constraints described above, I propose that development effort is focused on the alleviation of these constraints by addressing the following key issues:

4.1. Training of trainers, and training of farmers

4.1.1. Rationale

Beekeeping training in Rwanda seems to place emphasis on changing the type of hive used (from local hives to 'modern' hives) but without providing practical guidance and follow up. Beekeepers need training in: how to practice simple, sustainable beekeeping; how to maintain honey quality; how to separate honey from beeswax; how to render beeswax; manufacture of secondary products for value addition; how to make simple beekeeping clothing and equipment. Demonstration apiaries should display the best methods of beekeeping, and should be demonstrating how to 'add value' to the products of beekeeping.

4.1.2. Implementation

Rwandan beekeepers and their trainers would benefit from a ten-day training course concerning the following topics:

- Beekeeping practices and techniques relevant to and appropriate for Rwanda
- Knowledge of honeybee diseases and predators, and how to avoid them entering Rwanda
- The characteristics and uses of honey and beeswax
- Honey categories concerning origin and processing, and trade categories
- Processing honeycombs from fixed comb hives or top-bar hives
- Processing honeycombs from frame hives
- Post-harvest handling of honey and beeswax
- Honey and beeswax marketing

The course should include practical work and not be exclusively classroom based. Rwandan beekeepers need to increase volume of products, and gain market access. This in country *Training of trainers* program could be implemented by an external consultant.

Additionally, an excellent opportunity would be for trainers to attend the Apimondia Congress that will take place in Dublin in August 2005, with a special three-day practical Workshop for people from developing countries. See Annex C for details.

4.1.3. Financing

This intervention is appropriate to be financed by a donor organization.

4.2. Establishment of honey and beeswax collecting centres

4.2.1. Rationale

Beekeepers are constrained in how much they can earn from beekeeping because there is no certain, fair price available for their products. They are also constrained by lack of adequate containers to enable harvesting and processing of good quality products and lack of access to traders. This makes them susceptible to low prices offered by buyers. For an industry to develop, two processes are needed simultaneously: beekeepers harvesting significant quantity and quality of honey and beeswax, and a system in place to give a fair, immediate cash payment for products that are of good quality.

4.2.2. Intervention

To organize collection centres where beekeepers can bring their products and be certain of payment. When significant volumes of good quality honey and beeswax are available in one place, traders will be interested to travel to distant areas, being confident of the volume and quality they will be able to collect.

4.2.3. Location

Ideally, there should be a collection centre in each of Rwanda's Provinces.

4.2.4. Implementation

Each centre would function as a means of collecting honey and beeswax from beekeepers and then arranging its onward sale, either within Rwanda or for export. The collection centre could be owned by a co-operative, an NGO or private sector. The centre will alleviate existing constraints by providing beekeepers with lidded plastic containers for honey and beeswax collection (that remain the property of the centre). Depending on area covered, the centre may need to organize the collection of buckets from specified collection sites throughout the area.

This means that the centre must hire a vehicle to reach the collecting sites. Depending upon the market available for the honey and beeswax, the centre may carry out further processing of the products, sell to dealers or package honey for retail sale. Beekeepers would be paid according to the weight and quality of their products. At some central point, Kigali or elsewhere, there could be a central plant with capacity to process (i.e. to warm, filter and pack) honey. A collection centre buying 1 tonne of honey needs working capital of around 1m FRW (€ 1400, US$ 1703).

4.2.5. Infrastructure

The centres will need storage space for honey and beeswax, buckets, one honey refractometer, simple processing equipment, transport (motorcycle) and communication facilities. One staff person is needed during the season. Skills are needed in book-keeping and accounts, and skills concerning honey quality, processing and packaging. Outline requirements for one collecting centre are shown in Annex D.

4.2.6. Legal

Co-operatives would need legal establishment and their honey and wax may be eligible to receive international registration concerning 'Fair Trading'. In some areas, it may be possible to register the honey and beeswax as certified organic products (if harvested from land areas that have been certified as organic).

4.2.7. Risks

The risk is that the centres will not always be able to buy sufficient honey and wax to generate income to continue operation. There may be periods when little honey and wax are available, or when other buyers offer better prices to beekeepers. It may also be that beekeepers cannot be paid for their products immediately. In this case, the risk is that the beekeepers would rather gain a lower price but receive cash in hand. Another risk concerns international markets for honey and beeswax: currently these are strong, and are generally steady markets. As countries become industrialized, their demand for honey and beeswax increases.

4.2.8. Sustainability

It will be important that the centres have sufficient working capital to buy honey and wax so that they have viable quantities to interest traders. Once beekeepers have confidence in the centre then production should increase.

4.2.9. Multipliers

Honey is not a highly visible commodity. Better quality honey, presented in attractive containers for sale will stimulate local trade. It is anticipated that the stimulated market will lead to an increase of beekeeping activities.

4.2.10. Financing

Initial establishment of a collection centre may be appropriate for financing by a donor organization, but the centre should be immediately working towards self-financing; honey trading should not be donor subsidized.

4.3. Market development and training for honey traders and other stakeholders

4.3.1. Rationale

The local market attracts high prices for well-packed, imported honey. Much could be done to increase retail honey sales of Rwandan honey: improved packaging, diversification of packaging, especially packing in small volumes. Honey consumption increases according to living standards and people are keen to buy honey when it is well presented and they have confidence in the product. Concerning export and international prices for honeys, Rwanda will only have comparative advantage for specialized, niche market honeys.

However, the world honey trade is looking for new and interesting sources of honey, and the unique 'nationality' of the honey is the first step towards developing a niche product. Towards this development of viable honey and beeswax markets, potential private sector traders need training towards a good knowledge of the sector.

4.3.2. Intervention

Market development will involve interaction with consumers, traders and exporters, and media work promoting honey, to increase local honey consumption and sales, and creation of links with packaging suppliers and international traders.

The first aim of market development should be import replacement. Concerning export, potential exporters need to meet and make contact with international traders: there are two major forthcoming international events for this: details in Annex C.

For Rwanda to succeed in developing a "Niche Market Honey", the following steps would need to be taken:

1. The first task would be to ensure that beekeepers will have right of access.
2. Identify people who already have beekeeping or honey hunting skills and those who are interested to become beekeepers. Selection is an important step: many people are afraid of bees and it is important for potential beekeepers to have some genuine inclination towards the craft.
3. Build on existing knowledge and skills to develop beekeeping in the area.
4. Organise further training: I would recommend the use of local style hives and top-bar hives, rather than frame hives that I did not see working effectively in Rwanda.
5. Organise a honey collection centre (as described in report Section 4.2) and build confidence for beekeepers that they will receive fair and immediate payment for honey that meets set criteria
6. Organise finance such that the collection centre can buy from beekeepers during the season
7. Finance and organise the necessary organic and fair trade certification
8. Develop trade links and market access
9. For export to EU, organise a Residue Monitoring Scheme (see section 4.4), if this is not by that stage yet in place

It is further proposed that Mr. Murenzi (and other stakeholders as relevant) make a study tour to visit the company *North West Bee Products* (NWBP) in Zambia: this is probably Africa's largest beekeepers' cooperative, currently successfully exporting to the EU over 100 tonnes *per annum* of honey that is certified fair-traded (Germany) and organic (UK). Beeswax is also exported to the EU.

Further details of NWBP in Annex E. It could also be useful to see some of the successful honey collection centres in Uganda – these are operating on a smaller scale than NWBP, and will be similar in scale to any centres established in Rwanda. Contact details for Ugandan collection centres are shown in Annex E.

4.3.3. Financing

This intervention is appropriate to be financed by a donor organization.

4.4. Policy development

4.4.1. Rationale

The Ministry of Agriculture has no policy relating to apiculture. For export to the EU, Rwanda requires the creation of a '*Residue Monitoring Scheme*' so that Rwanda may join the EU's list of '*Third countries*' from which EU countries may import.

4.4.2. Intervention

The Ministry of Agriculture needs a National Policy with priorities and sector plan to protect and promote the apiculture industry. In particular, legislation should be in place to prevent the introduction of exotic disease by humans bringing in bees or used beekeeping equipment from elsewhere. The Ministry also has a role in protecting bees from pesticides and ensuring bee populations for the adequate pollination of crops.

4.4.3. Implementation

The policy can be developed by an appropriate external consultant working in consultation with stakeholders.

4.4.4. Financing

This intervention is appropriate to be supported by a donor organization.

ANNEXES

Annex A: Task Order Scope of Work /Determination of Improvements Required for Production of Export Quality Honey in Rwanda

I. Background

USAID/Rwanda's Strategic Objective Number Three (SO3) seeks to increase the ability of rural families in targeted commodities to improve household food security by positioning agribusiness operators and their entire commodity sectors on sustainable and expandable growth.

To facilitate the agribusiness private sector revitalization in Rwanda the USAID mission has under a RAISE IQC designated Chemonics International Inc., a Washington DC-based consulting firm with agribusiness experience in over 100 countries, to implement the mission's Agribusiness Development Assistance in Rwanda (ADAR) project. The ADAR project seeks to:

- ***Add value*** to key commodities targeted *for* ***export***
- ***Build efficiency*** and expand employment within ***commodity chains***
- ***Upgrade managerial and technical capability*** in agribusiness enterprises
- ***Improve product quality and expand access to markets***
- ***Develop financing options*** to support agribusiness growth

Special Features and Benefits in the ADAR program include the following:

- **Agribusiness Centre (ABC)** to serve as the "Information Central" for Rwanda's agribusiness community offering current market information, expanded commercial contacts, and technical assistance, all to keep motivated agribusiness operators informed
- **Special Initiatives** to break through operational, market, technical and financing obstacles which may confront enterprises seeking to accelerate sales and export
- **Training** through carefully prepared modules to sharpen production, marketing, planning and financial management skills, and through less formal workshops and seminars, both on a continuing basis to improve client enterprise performance
- **Financial Access** through a program of orientation and training for bankers and for professionals offering agribusiness support services to individual enterprises and associations that need to apply for credit.

II. Objective and Nature of Services Required

Many Rwandans are involved in beekeeping and honey production, and the volumes produced are believed to be considerable. Because the domestic demand for honey is limited, however, much of the product is sold at very low prices or used in the manufacturing of local beer or wine. If Rwanda could export its honey to EU and other international markets, the beekeepers would receive a much higher price for their product, which would contribute greatly towards poverty alleviation. At present, Rwanda's honey is not of export quality; most is produced using traditional beehives and rudimentary harvesting practices. An analysis of Rwandan honey samples conducted by the International Centre for Insect Physiology and Ecology (ICIPE) in Nairobi revealed that the honey was contaminated by a smoky flavour (from too much smoke used in harvesting), that it was at times harvested prematurely and that it had been overheated/exposed to sunlight/stored for overly long periods. ICIPE's recommendation was that Rwandan honey could be improved and brought up to EU standards if beekeepers were given proper training. In order to determine the areas where Rwandan honey production and processing need to be improved, there is need for a study to be conducted in country by a beekeeping/honey specialist in order to elucidate the greatest problems and propose solutions to overcome them.

III. Specific Tasks to Be Performed

In order to achieve the above objective, the consult will:

- Visit a representative sample of beekeepers in the most important honey producing areas of Rwanda and observe their beekeeping and honey harvesting practices
- Formulate recommendations for correcting beekeeping and honey harvesting practices which result in a poor quality product
- Study the post harvest handling of honey in order to determine where quality losses are occurring
- Recommend improved techniques for post harvest handling, including equipment, as and when is necessary
- Propose a plan for training beekeepers so that they can achieve export quality honey as well as a plan for honey collection, packaging, transport and storage which prevents/minimizes post harvest losses in quality

IV. Personnel and Qualifications

The consultant will have an in-depth knowledge of beekeeping, honey harvesting, processing, packaging and storage procedures required for the production of EU-grade honey. S/he will have worked extensively with developing country beekeepers, preferably in sub-Saharan Africa and be familiar with EU and other international honey markets. The individual should be fluent in English or French; a working knowledge of the other language is also desirable. Knowledge of Kinyarwanda or Swahili would be an additional advantage.

V. Level of Effort

The total time required will be 11 days, partitioned as follows:

- 7 days in country (5 days of field visits, 2 days preparing and delivering a presentation of findings)
- 2 days for final report writing
- 2 days travel time (to/from Rwanda)

VI. Deliverables

The deliverables for this consultancy are:

- A presentation of findings to ADAR, potential investors in the honey sector and other players involved in the development of Rwandan honey for export
- A detailed report covering tasks cited in **Section III;** a draft copy of the report should be submitted electronically to ADAR within one week after the consultant has left Rwanda. After receiving comments and observations on the draft report from ADAR, the consultant will have one week to prepare and submit the final electronic version of the report.

G. Roles and Responsibilities

ADAR will place at the disposal of the consultant the requisite logistical support, including project vehicle and chauffeur, to facilitate accomplishment of the aforementioned objectives and outputs. The consultant will report directly to the Chief of Party or his designee.

Annex B: Persons consulted

ADAR

Maurice Wiener	Chief of Party
Anne Turner	Horticultural and Commodity Development Specialist
Jean Bosco Seminega	Business Development
Anastase Murekezi	Training Specialist
Pierre Cêlestin Habyazimana	Consultant
Donatien Murenzi	Murenzi Supply Company
Espérance Ngamije	Ministry of Agriculture and Animal Resources

Beekeepers, groups and NGO personnel

Mark Mwine	International Gorilla Conservation Programme
Guillaume	ORTPN
Bernard Butera	FAV Treasurer
Mwamubanza Appollinaire	FAV President
Ildéphonse Ngahagome	FAV Technician
Camille Nsengiyumva	BAIR, Gisenyi
Aloys Semakuza	BAIR, Gisenyi
Jean Bosco Tumusifu	Twibumbebavumvu Association, Nyakizu District, Butare Province
Sophanie Banyangarwinshi	President, IMPAKOKA
Eugène Ntasingwa	ARDI
Claude Mugemanya	Cefores NGO Coordinator
Jean Claude Nsabima	Cefores Vice President
Jean d'Amour Kagoyera	District Planner

Annex C: Forthcoming events recommended for participation by Rwanda apiculture stakeholders

APIMONDIA International Apicultural Congress

IRELAND 21-26 August 2005, Dublin

Apimondia is the World Federation of Beekeeping Associations, founded over 100 years ago to promote and protect the interests of beekeeping worldwide. Apimondia is run by a General Secretariat in Rome, Italy, and derives its funds from its members - national beekeepers' associations worldwide. A major activity of Apimondia is the Congress that it organizes every second year: these events are the largest international gatherings in the apicultural world. The next Congress will be held in Dublin in August 2005. It will be attended by thousands of people, representing all facets of apiculture and every sector concerned with bees: commerce, research, traders in products and equipment, those involved with development work, large- and small-scale beekeepers, environmentalists and government representatives.

Apimondia works to represent the interests of the apiculture sector by means of seven *Standing Commissions*. These are: Apitherapy, Bee biology, Bee pathology, Beekeeping economy, Beekeeping for rural development, Beekeeping technology and equipment, and Melliferous flora and pollination.

This Congress in Dublin will include a three-day training workshop, teaching beekeeping methods appropriate for the natural resources, economic and social conditions prevailing in developing countries. This Workshop will be taught by experts from Africa and Europe. Course participants will learn the practicalities of low technology beekeeping and how to help people generate income from indigenous bees in wholly sustainable ways.

Further details: www.apimondia2005.com

APIMONDIA SYMPOSIUM
Issues concerning developing countries' international trade in honey

VIETNAM 23-28 November 2004, Hanoi

The Symposium will be a forum for producer groups, traders and researchers to increase their knowledge and discuss issues critical to the world honey trade, with specific reference to developing countries. New trade opportunities are arising because of world market demand for residue-free sources of honey. The prevailing market conditions present an ideal opportunity for small producer nations to enter the market, yet producer groups in developing countries remain unaware of the changing market situation. Participation in the Symposium should enable producer groups to gain access to the world market, and international traders to identify new sources of residue-free honey.

Further details from:
Mr. Dinh Quyet Tam
Bee Research and Development Centre
Langha, Dongda
Hanoi, VIETNAM
Fax +84 4 835 2725
Phone +84 4834 3185
dinhqtam@hn.vnn.vn

Annex D: Outline requirements for a honey collection centre

Fixed costs

Building: storeroom, office, workshop, with electricity, water, telecoms.

Buckets

250 kg drums

Sieves or materials for filtering honey

Large honey tanks

1 solar wax extractor

1 refractometer

Scales for weighing

Motorbike or other transport

Recurrent costs

Staff costs

Manager: book keeping and accountancy skills, honey quality skills

Temporary staff for busy periods (honey seasons)

Consumables

Transport cost

Water

Telecomm.

Electricity

Office consumables

Packaging consumables

Credit costs

Annex E: Background details of honey marketing groups in Africa

ZAMBIA

North West Bee Products

North West Bee Products (NWBP) is a company owned by its 6500 beekeeper-members. NWBP is exports honey and beeswax to the EU: the 'Body Shop' is a major customer. Bob Malichi has been Manager of NWBP since 1988. The Company buys honey from the beekeepers using local style bark-hives in the North Western Province of Zambia. The beekeepers are all shareholders in the Company and debate policy and prices at an annual conference. Under Bob Malichi's management, the Company has achieved the following:

- A cash income for more than one thousand families, despite the collapse of most other services to the rural communities
- The first ever UK Soil Association certification for organic honey
- Export of honey to the EU for the past ten years or so
- Ensured that NWBP honey meets increasingly rigorous Port Health inspections
- 'Fair trade' certification from Germany
- NWBP and Bees *for* Development are currently cooperating on a UK DFID/BLCF Project concerning naturally occurring antibiotics present in honey.

Contact details:

North West Bee Products
Manager: Bob Malichi
PO Box 96
Kabompo
ZAMBIA Tel/Fax (+260) 08 375085 (No e-mail yet)

UGANDA

UWESO

UWESO is a Ugandan NGO that has had success with organizing honey marketing and runs five honey and beeswax collection centres throughout Uganda. The scale of these collection centres, and volumes and types of honey will be similar to those that could be developed in Rwanda

Contact details:

UWESO
Field Director: Baker Waiswa
PO Box 16305
Kampala
UGANDA Tel/Fax (+256) 041 348 391
E-mail uktrust@swiftuganda.com

Annex F: Contact details of potential honey traders in the EU

Belgium

Benoît Olivier
Miel Maya Honing asbl
rue de Steppes, 26
B-4000 Liège
BELGIUM

Tel.: 32 (0)4 380 06 18
Fax: 32 (0)4 380 45 99

E-mail: benoit.olivier@maya.be
www.maya.be

Netherlands

Leo Poppelaars
de Traay BV
Platinastraat 50
8211 AR Lelystad/Neth
Fax 0031 320 28 20 28

E-mail: info@detraay.nl

UK

Brian Butcher
Rowse Honey Ltd.
UK
brian.butcher@rowsehoney.co.uk

Tropical Forest Products Ltd
PO BOX 92,
Aberystwyth
SY23 1AA
Tel/Fax: 01970 832 511
mail@tropicalforest.com

Annex G: Recommended Materials for Further Information on Honey Production and Marketing

BEES *FOR* DEVELOPMENT JOURNAL

A quarterly magazine that is the only publication dealing specifically with beekeeping in the context of rural development, and gives current news on legislation, events, projects, training opportunities etc.

STRENGTHENING LIVELIHOODS: EXPLORING THE ROLE OF BEEKEEPING IN DEVELOPMENT
Nicola Bradbear, Ele Fisher, Helen Jackson
Essential reading for all who plan or implement development work involving apiculture.
2002 122 pages

BEEKEEPING: A BEGINNER'S GUIDE
Tom Carroll
Useful information for beginners in Kenya and other African countries.
1997 37 pages

BEEKEEPING AND SOME HONEYBEE PLANTS IN UMALILA SOUTHERN TANZANIA
Paul Latham
Descriptions of 74 plant species and their value for bees.
1999 92 pages 100 colour photographs

BEEKEEPING IN BAS CONGO, DR CONGO WITH PARTICULAR REFERENCE TO SOME IMPORTANT BEE PLANTS
Paul Latham
Many of the plants described are found throughout the humid, tropical regions of Africa.
2000 84 pages A4 spiral bound with colour photographs on most pages

BEEKEEPING HANDBOOK
Ministry of Agriculture (Botswana)
Good information on how to work with African bees.

LOW PRODUCTIVITY IN EAST AFRICAN BEEKEEPING *Njiro Wildlife Research Centre*
Papers discussing the use of appropriate equipment, honeybee management, training, and extension.
1997 80 pages

HONEY HUNTERS AND BEEKEEPERS. TRADITIONAL BEEKEEPING IN BABATI DISTRICT, TANZANIA
G M Ntenga & B T Mugongo
Unique study of the role of beekeeping in an African society. 1991 82 pages

PERSPECTIVES FOR HONEY PRODUCTION IN THE TROPICS
Sommeijer, Beetsma, Boot, Robberts & de Vries
Information about harvesting tropical honey, and local and international marketing. 1997 214 pages

VALUE-ADDED PRODUCTS FROM BEEKEEPING
Rainer Krell
Extra income by "adding value" to bee products. Recipes using honey, pollen and wax. 1996 409 pages

SUPER FORMULAS
Elaine White
How to make more than 360 useful products that contain honey and beeswax. 1993 120 pages

POLLINATION OF CULTIVATED PLANTS IN THE TROPICS
David W Roubik
Pollinators in tropical agriculture, pollination methods, and ecological considerations. 1995 196 pages
Videos

AFRICAN HONEYBEES*:* HOW TO HANDLE THEM IN TOP-BAR HIVES
Script by Bernhard Clauss
Excellent introduction on how to work with African bees, using low cost equipment. 1995 22 minutes PAL/VHS

BEEKEEPING IN DEVELOPMENT
Horst Wendorf
Three films on one tape: Appropriate beekeeping technology; Processing and marketing of bee products; Management of bees in top-bar hives.
The videos show the work of a project in Zambia; people handling bees gently and expertly; and creating maximum income from the products.
1999 81 minutes PAL/VHS

All of these texts and videos, as well as others, are obtainable via Bees *for* Development's website: **www.beesfordevelopment.org.**